

# BIOSYSTEMATIC STUDY OF TWO NEW SPECIES OF *CHENOPODIUM* FROM THE NORTH INDIAN PLAINS<sup>1</sup>

S.C. PANDEYA, GEETA SINGHAL AND ANIL K. BHATNAGAR<sup>2</sup>

(With four text-figures)

**Key words:** *Chenopodium santoshei*, *C. cyanifolium*, leaves, stem, colouration, stigma.

Two populations of *Chenopodium* aggregate occurring in the north Indian plains have been distinguished and described as *Chenopodium santoshei* sp. nov. and *C. cyanifolium* sp. nov.

## INTRODUCTION

*Chenopodium album* and its allies (non-aromatic, edible), belonging to family Chenopodiaceae, are cosmopolitan (Uotila 1976-1978, 1988, 1993 a, b, c) annual herbs. They occur naturally throughout the north Indian plains as weeds in cultivated winter crop fields, in gardens, among debris and other moist places, flowering from November to April. The ecoclimate of the region is tropical semi-arid, and the soil is Pleistocene and fresh alluvia.

In the region, at least two distinct populations of *Chenopodium* aggregate occur, which differ from known species of the genus. Both are non-aromatic and edible. They are:

1. *CC* (greyish-cyan leaves) - An erect, tall, herbaceous plant, starts growth in October/November, flowering February to April; height upto 2.50 m; stem ridged, almost uniformly purple, basal branches longer (upto 65 cm), decumbent, giving the mature plant a triangular shape; leaves - petiole reddish green, lamina greyish-bluish-green (cyan), petiole equal to or longer than lamina, lamina ovate, bracts elliptic, margins soft dentate, lamina 1.2-4.5 x 0.6-3.2 cm, petiole 0.5-3.3 cm, leaf primordia greyish

green, mealiness on young stem, leaves and perianth; inflorescence greyish-bluish-green, spikes terminal (30 cm) and axillary, flowers - perianth 5, central vein less prominent, stamens 5, equal to perianth, feathery stigma bi- and trifold, longer; seed covered with pericarp with a circular opening on the top, disc-shaped, 1 mm x 0.98 mm, thickness 0.56 mm, colour Hue 5R 2/1 (Figs. 1 and 2). Deposited at Kew, vide ours DEI 102.

2. *CS* (entire red) - An erect, tall (2.0-3.5 m) herbaceous plant, starts growth in November, flowering February to April; stem ridged in the beginning, smooth on maturity, branching throughout, almost uniformly scarlet, stele scarlet (as seen in transverse section), middle branches longest upto 1.3 m, shape of plant oblong, diameter of main stem at base upto 4.5 cm, young branches reddish green; leaves greenish-red on dorsal side, green on ventral side with scarlet veins, leaves turning completely crimson upon senescence, shape hastate, three-lobed, middle lobe oblong, basal 2 lobes pointing upwards with one large and one small dentation, apex of middle lobe acute to obtuse, 2-3 dentations, lamina with heavy mealiness on young leaves (also on young stem and perianth), getting glabrous on maturity, leaf primordia scarlet, lamina 1.5-8.5 x 0.6-6.6 cm, petiole 0.8-9.2 cm (longer than lamina), ratio of length/width of lamina 1.28, between lamina and petiole 0.92; spikes terminal on main stem upto 18 cm

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<sup>2</sup>Botany Department, Dayalbagh Educational Institute, (Deemed University), Dayalbagh, Agra-282 005.

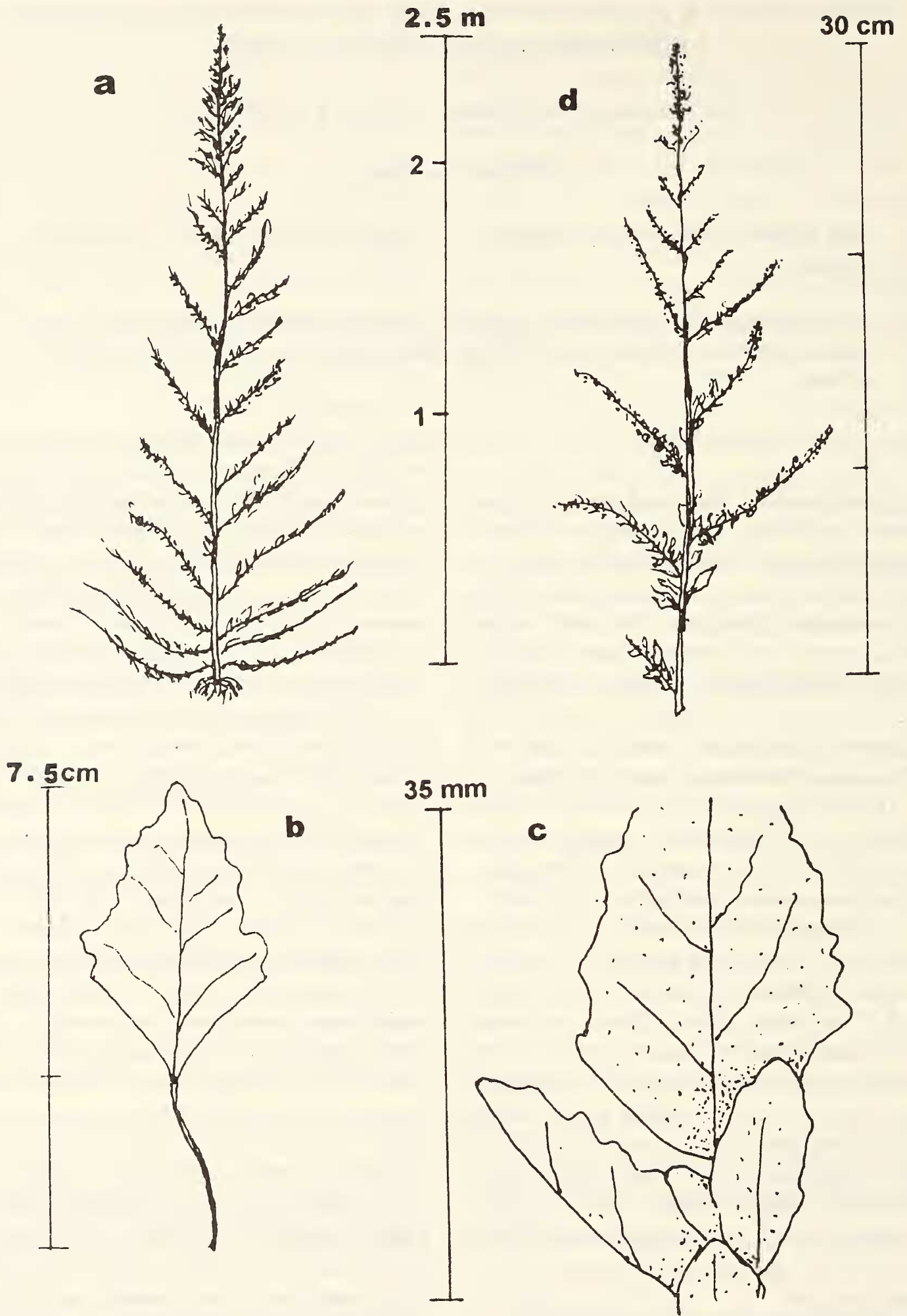


Fig. 1: *Chenopodium cyanifolium*: a. Branching pattern and shape of a mature plant, b. mature leaf, c. leaf primordia, d. flowering shoot

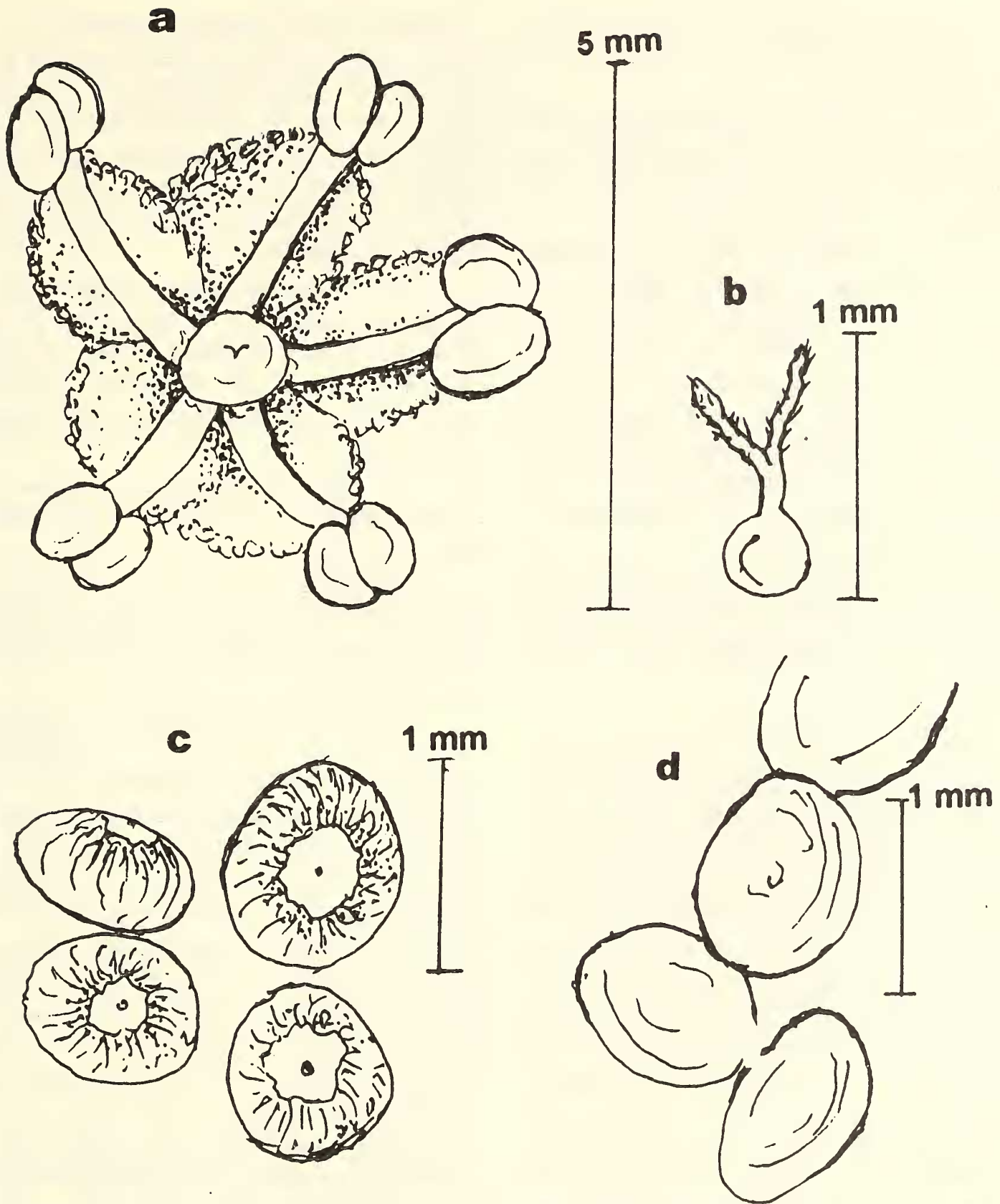


Fig. 2: *Chenopodium cyanifolium*: a. open flower, heavy mealiness on perianth, filaments (of stamen) equal to perianth, b. bifid stigma, c. seeds with pericarp, d. seeds without pericarp

along with branches, greenish red spikes on all primary, secondary and tertiary branches from base upwards, bracts broad lanceolate but with two small projections on either side; flowers, perianth 5, connate at base, margins scarlet, stamen 5, filament longer than perianth, feathery

stigma 2, 3, 4-fid, smaller than CC, perianth midrib not prominent, pericarp adherent with a circular opening on top; seed disc-shaped (biconvex), notched with a depression, length 0.92 mm, width 0.89 mm, thickness 0.51 mm, colour Hue 5R 2/1, weight of 100 seeds with



pericarp 0.0270, without 0.0243. Fig. 3 and 4 Type - north Indian plains, Agra, deposited at Kew, our DEI 103.

Both *CC* and *CS* populations have been clubbed together in different Indian Floras under *Chenopodium album* Linn. and described as variations in morphological characters (Hook.f.in Fl. Br. Ind. 5:3, 1886; Prain, Bengal Plants, 2:879, 1903; Cooke, Fl. Indian desert, Sr. 4:968 (65), 1919; Gamble, Fl. Pres. Madras, Pt. IV: 1179, 1921; Duthie, Fl. Upper Gang. Plains & Adj. Siw. Sub-Him. Tr. 1903-29; Maheshwari, Fl. Delhi 302, 1963; Saldanha and Nicolson, Fl. Hassan Dist. Karnataka, India. 101, 1976; Babu, Herb. Fl. Dehradun, 436-37, 1977; Kaushik, Fl. Shivpuri, 279, 1983; Bhandari, Fl. Indian desert, 296, 1990.

In the present communication, an attempt has been made to clearly distinguish the two populations and to assign them to their correct systematic position.

## TAXONOMIC CONSIDERATION

Specimens of both *CC* and *CS* were sent to the authority on the subject, Prof. Pertti Uotila, Helsinki, Finland, for his opinion. He wrote "*CC* seems to belong to *Chenopodium strictum* Roth. It is fairly badly known (sic) species described from India, and widely distributed but divided into several races. The stem is typically violet red, inflorescence spiciform and seeds smaller and more oval than in *C. album*. The leaf shape (in our material) is somewhat odd compared with the material I have seen earlier." In the present study *CC* does not tally with *C. strictum* or its known subspecies. Table 1 gives a comparative description of *C. strictum* Roth and its two subspecies, viz., *strictum* and *striatiforme* and the present *CC*. From the table it becomes clear that *CC* is a separate taxon and hence is being elevated to the rank of species, named:

*Chenopodium cyanifolium* Pandeya et al. sp. nov.

It is being characterised as:

Herba erecta, 2.5 m alta, cortice purple; lamino grey cyano, ovatis; petiolum aequalibus

vel quam laminum longior (Lamino 4.5 x 3.2 cm, petiolata 3.3 cm alta); Inflorescence grey-cyano, stigma longior, bi-trifidus; Foliis extracta pH 7.72, sp. con. 38  $\mu$  mho; Floribus Feb.-April. Holotypus: Lectus in Dayalbagh, Agra (India). Positus in herbario die Botany Department, Dayalbagh Educational Institute, Agra, India sub numero accessionis 102.

*Chenopodium* folis rhomboideo - triangulari - album bus erofis poftice integris: fummis oblongis, racemis erectis. Fl. fuec. 212. Dalib, parif. 80 *Chenopodium* folis enferiorbus ovatis anthrorfum dentatis: fummis lanceolatis.

Vir. Cliff. 22 Hort Cliff. 85. Gron. virg. 145 Roy. lugdb. 219. Hall belv. 175. Habitat in agris Europa:

**Etymology:** *C. cyanifolium* has been named after the greyish-cyan colour of leaves and inflorescence, not present in any other species of *Chenopodium*.

Regarding the *CS* population, Uotila (pers. comm.) opines that "your *Chenopodium santoshei* belongs to *C. ficifolium* Sm., s. lat., e.g., on the basis of seed characters. This species seems to be variable especially in India and SE Asia. Two subspecies have been distinguished, mainly on the basis of seed coat characters: subsp. *ficifolium* (European) and subsp. *blomianum* (S and SE Asiatic). The latter have been divided into several races on the basis of leaf characters. However, leaf size and shape vary much within all taxa of *Chenopodium*, and based on my insufficient knowledge on Indian material, I am not willing to definitely say which kind of taxonomic recognition your specimen deserves, if any. It has exceptionally large and broad leaves for the species. Further red colour is exceptional, even though not unknown in *C. ficifolium*.

Table 2 gives a comparative account of *C. ficifolium* and its two subspecies along with *CS* population. The distinction is clear from the table. Hence, *CS* population is being named as:

TABLE I  
COMPARATIVE STATEMENT OF MORPHOLOGICAL CHARACTERS OF *CHENOPODIUM STRICTUM*, *C. S. STRICTUM*, *C. S. STRIATIFORME* (MURR.)  
UOTILA AND *C. CYANIFOLIUM* SP. NOV.

Characters	<i>Chenopodium strictum</i> Roth. Nov. Pl. Praes. Ind. or J. Murr. & Uotila.	<i>Chenopodium strictum</i> <i>strictum</i> (Krasan) J. Murr. & Uotila.	<i>C. striatum striatiforme</i> (Murr.) Uotila comb. nova.	<i>C. cyanifolium</i> sp. nov.
Habit	—	Annual, upto 2 m tall, erect.	Height usually less than 40 cm, but sometimes 100 cm; erect to ascending.	Tall erect herb upto 2.5 m.
Stem	—	Green-striped, sometimes red especially in axils.	Stem and main branches yellowish to reddish, striped with various shades of green, sometimes violet red in the basal part.	Striped, uniformly purple, small branches reddish green.
Branching	Branching on the basal part	Branched mostly basally, lowermost branches long, ascending from almost horizontal base.	Usually richly branched basally, basal branches long and procumbent to ascending after a shortish horizontal part (typical of <i>glaucophyllum</i> and <i>strictum</i> subspecies).	Basal branches longer, upto 65 cm, decumbent, giving the plant a triangular shape, young stem and young branches with heavy mealiness.
Leaves	Elliptic, glaucous	Lamina dark olive green to glaucous green above, glaucous green below, sometimes red rimmed, c. 2 x length of petiole, 2-5 x 3-2.5 cm; ovate to elliptic, somewhat attenuate towards apex, margins almost parallel in the middle part, margins $\pm$ regularly toothed, teeth small, sometimes with a pair of longer teeth at broadest point of lamina, sometimes margins entire; apex rounded; lamina of upper leaves (rarely of all leaves) narrowly trullate to narrowly elliptic, margins entire.	2-2.5 (-3.5) x 0.7-1.0 (-2.0 cm), rhombic trullate, with a cuneate base, margins entire to dentate, teeth ranging from blunt and shallow to fairly large, sparse and irregular, glaucous on the lower surface and margins often reddish, upper leaves and those on the branches have fairly long petiole, lamina elliptic 1- 3 cm x 0.5 - 1.0 cm.	Ovate, lamina greyish bluish green (cyan), petiole reddish-brown, young leaves with heavy mealiness, shoot apex ( <i>primordia</i> ) greyish green, margins bluntly toothed pointing upwards, apex obtuse to somewhat pointed, petiole equal or longer than lamina, upto 4.5 x 3.2 cm, petiole upto 3.3 cm, upon senescence leaves turn olive green.



TABLE I (CONTD.)  
 COMPARATIVE STATEMENT OF MORPHOLOGICAL CHARACTERS OF *CHENOPODIUM STRICTUM*, *C. S. STRICTUM*, *C. S. STRIATIFORME* (MURR.)  
*UOTILA* AND *C. CYANIFOLIUM* SP. NOV.

Characters	<i>Chenopodium strictum</i> Roth. Nov. Pl. Praes. Ind. or. J. Murr. & Uotila.	<i>Chenopodium strictum</i> <i>strictum</i> (Krasan) J. Murr. & Uotila.	<i>C. strictum striatiforme</i> (Murr.) Uotila comb. nova.	<i>C. cyanifolium</i> sp. nov.
Inflorescence	Flowers concentrated in small glomerules, mostly arranged in terminal and usually spiciform branched inflorescence.	Flowers in fairly small compound glomerules, giving spike like appearance to more or less elongated branches of the inflorescence.		Terminal spikes long upto 30 cm, compact glomerules, spikes on branches small, inflorescence greyish bluish-green.
Flowers	Small, perianth olive green, united at the base, keel not prominent.	Small.		Flowers not small, perianth not small, perianth connate at base, stamen filaments equal to perianth, feathery stigma bi-trifid, long, mealliness on perianth, perianth greyish green, keel on perianth less prominent.
Fruit and Seeds	Fruits falling with perianth, pericarp easily detached, seed horizontal black, lustrous, 1.0-1.2 mm in diameter, somewhat ovate, length/width 1.12, thickness 0.55 mm.	Seed length 1.14 mm, length/width 1.10, thickness 0.55, notched.		Pericarp completely adherent with a circular opening at the top, seed colour HUE 5R 2/1, length 1 mm width 0.98 mm, thickness 0.56 mm, weight of 100 seeds with pericarp 0.0344, without pericarp 0.0312 g, seeds notched.

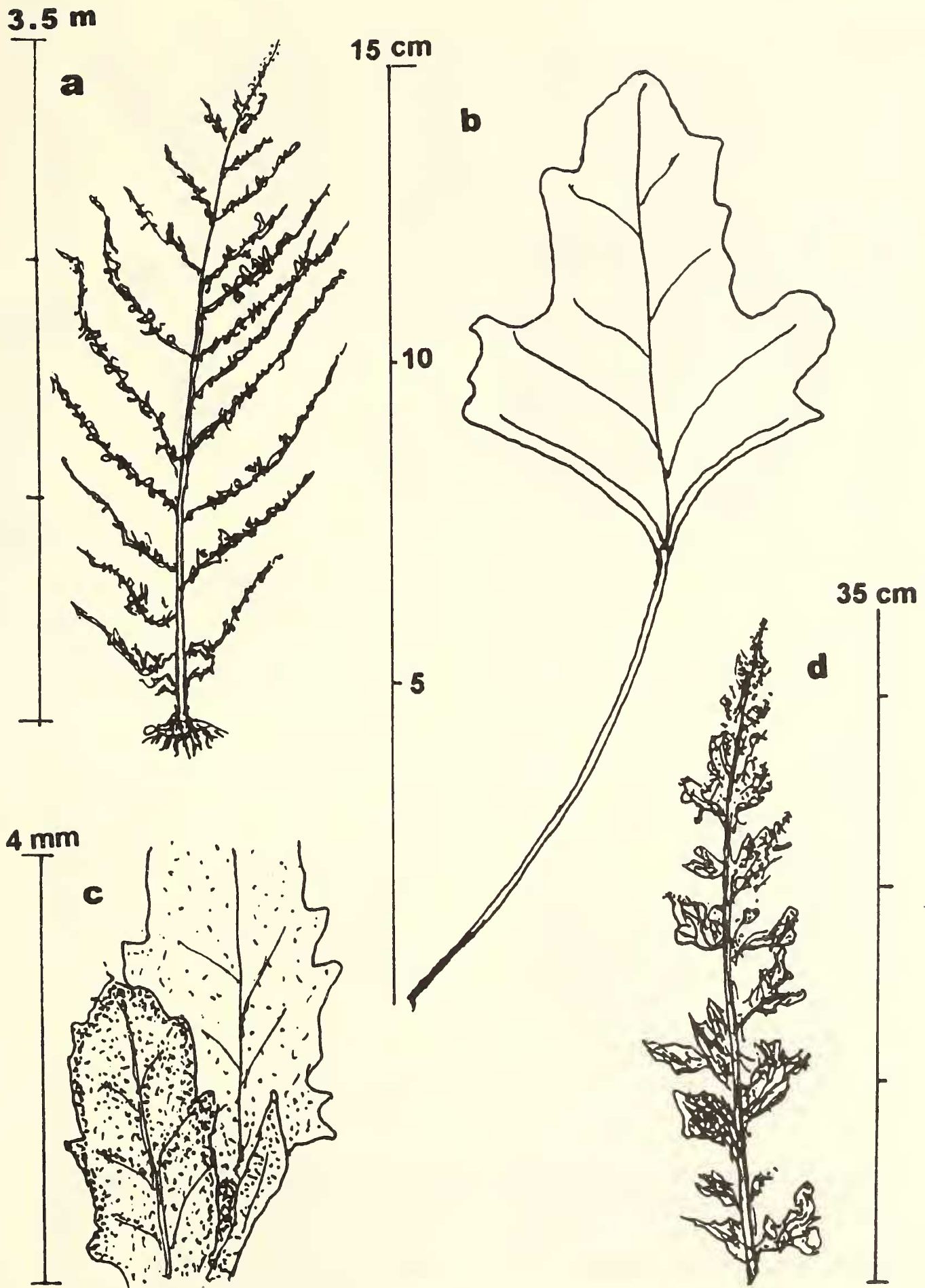


Fig. 3: *Chenopodium santoshei*: a. branching pattern and shape of a mature plant, b. mature leaf, c. leaf primordia, d. flowering shoot

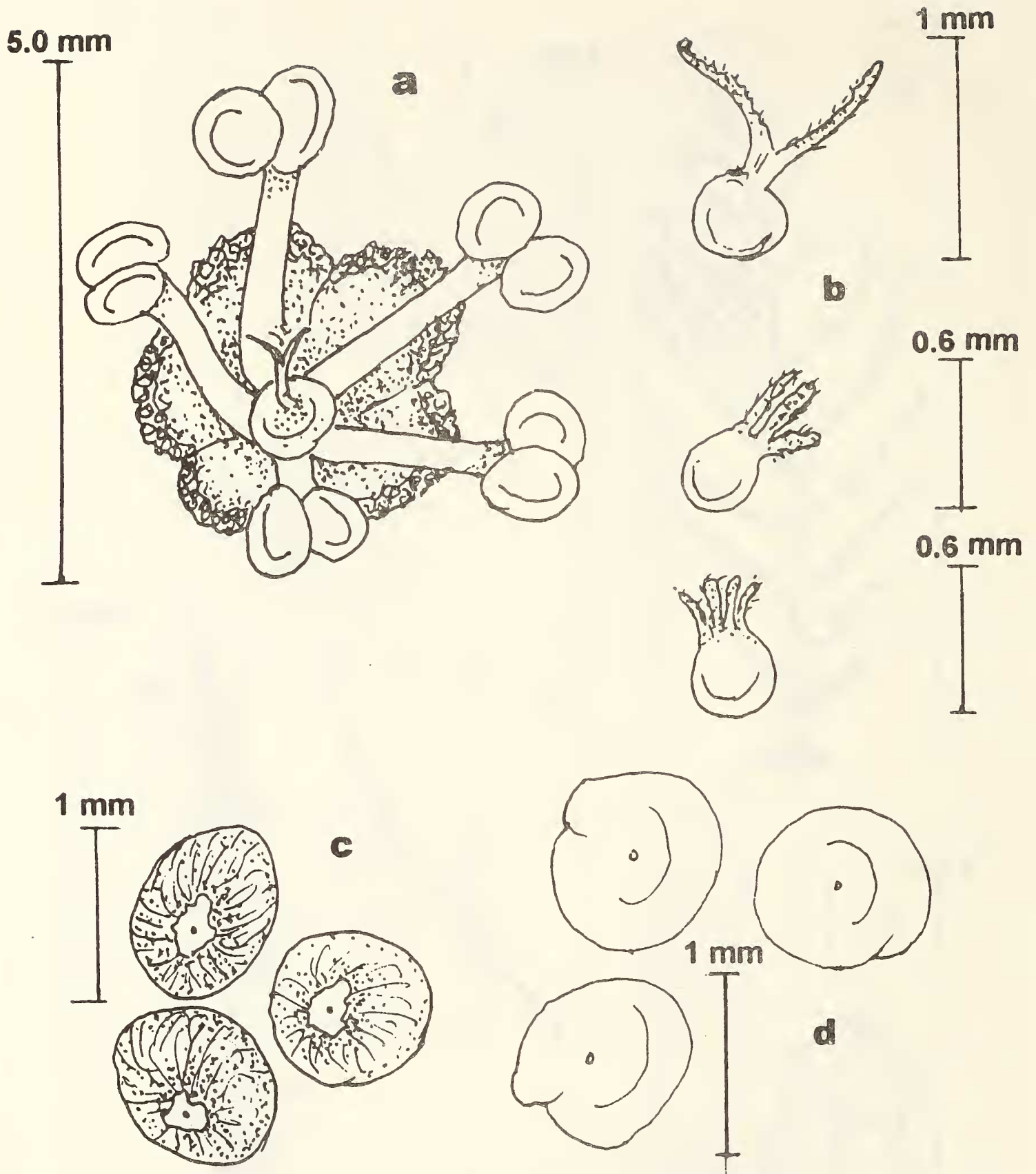


Fig. 4: *Chenopodium santoshei*: a. flower, filaments of anthers longer than perianth, b. long bifid, trifid and quadrifid stigma, c. seeds with pericarp, d. seeds without pericarp

*Chenopodium santoshei* Pandeya et al. sp. nov. Lucknow.

**Etymology:** The species has been named in honour of Dr. Santosh Chandra Pandeya, who first showed the plant to the senior author at

*Chenopodium santoshei* is being characterised as:

Herba erectus, 3.5 m alta; Trunkus diam. 4.5 cm; caulis rami, petiolata, foliis nervo rosea;



TABLE 2

COMPARATIVE STATEMENT OF MORPHOLOGICAL CHARACTERS OF *CHENOPODIUM FICIFOLIUM* SM., *C. F. FICIFOLIUM* (HEGI 1960)  
 UOTILA, *C. F. BLOMIANUM* (AELEN) AELEN AND *CHENOPODIUM SANTOSHEI* SP. NOV.

Characters	<i>Chenopodium ficifolium</i> Sm.	<i>Chenopodium ficifolium ficifolium</i> (Hegi, 1960) Uotila 1993	<i>C. ficifolium blomianum</i> (Aellen) Aellen	<i>C. santoshei</i> Pamdeya et al. sp. nov.
Height	20-70 cm.	-	-	2-3.5 m
Stem	Erect, green, striped, sometimes yellow or tinged with red, rarely with red spots in leaf axils.	-	-	Erect, ridged, almost uniformly scarlet, stele of stem scarlet as seen in transverse section, mature stem at base circular, diameter at base upto 4.5 cm
Branches	Branches spreading, fairly short.	Branches mainly in upper parts	Much branched in basal parts	Branching throughout from base to top, middle branches longest upto 1.3 m, diam. 1.0 cm, mature branches reddish green
Leaves	Fairly thin, glabrous or farinose, petiole as long as or shorter than lamina, lamina 2-5 cm, elliptic or ovate, usually with forward projecting tooth or lobes on both sides near base, middle lobe ± oblong, with several teeth or sometimes subentire, obtuse to truncate at apex	Mostly pure green, large, usually with prominent side lobes, middle lobe entire or dentate	Greyish-green, small to fairly large, truncate at apex, dentate, side lobes usually not very prominent or if so, the middle lobe broad and short	Reddish-green on dorsal side, green with blue tinge ventrally, veins scarlet, leaves turning crimson upon senescence, shape hastate, 3-lobed, basal 2 lobes broad and pointing upwards with one large and one small dentation, middle lobe large with parallel margins or so, 2-3 dentation on the upper side, apex acute to dome-shaped, young leaves with heavy mealiness on ventral and lighter on dorsal surface, mature leaves glabrous on upper surface, petiole always longer than lamina, lamina upto 8.5 x 6.6 cm, petiole 9.2 cm, ratio of L/W of lamina 1.28, and between length of lamina/petiole length 0.92, shoot apex (primordia) scarlet.

TABLE 2 (CONTD.)

COMPARATIVE STATEMENT OF MORPHOLOGICAL CHARACTERS OF *CHENOPODIUM FICIFOLIUM* SM., *C. F. FICIFOLIUM* (HEGI 1960) UOTILA, *C. F. BLOMIANUM* (AELLEN) AELLEN AND *CHENOPODIUM SANTOSHEI* SP. NOV.

Characters	<i>Chenopodium ficifolium</i> Sm. Fl. Brit. I: 276, (1800)	<i>Chenopodium ficifolium</i> <i>ficifolium</i> (Hegi, 1960) Uotila 1993	<i>C. ficifolium</i> <i>blomianum</i> (Aellen) Aellen	<i>C. santoshei</i> sp. nov.
Inflorescence	Terminal, much branched rather loose panicle, leafless only in terminal parts, bracts narrowly lanceolate, usually entire, glomerules small.	-	-	Terminal on main stem (upto 16 cm) and on all primary, secondary and tertiary branches from base upwards, spikes compact, greenish red, bracts broad lanceolate but with two small projections on either side near middle.
Flowers	Perianth segments connate to middle, stigma 2.	-	-	Perianth connate at base with scarlet to crimson border and heavy mealiness on outer side, filament of stamen longer than perianth, feathery stigma shorter than CC population, stigma 2,3 or 4-fid, purple.
Fruits and Seeds	Pericarp fairly adherent seeds horizontal, black 0.8-1.0 mm, roundish in margins obtuse.	Pericarp somewhat adherent.	Pericarp fairly adherent.	Pericarp completely adherent with a circular opening on the top, seed disc-shaped (biconvex), notched with a depression, length 0.92, width 0.89 mm, thickness 0.51 mm, colour of seed HUE 5R 2/1, weight of 100 seeds with pericarp 0.0270, without pericarp 0.0243 g.

foliis hastatus, 3 lobus, lamina 8.5 x 6.6 cm; petiolum 9.2 cm alta; foliis primordium rosea; perianthus rosea; stamen filament longior quam perianth; foliis extracta: pH 6.0, sp. Con 45  $\mu$  mho; Floribus Feb.-April. Holotypus: Lectus in Dayalbagh, Agra et Lucknow (India). Positus in herbario die Botany Department, Dayalbagh Educational Institute, Agra, India sub numero accessioris 103.

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